Hitachi Inverter

SJ200-2/L200-2 SERIES

SJ2-CO (CANopen Interface Option)

INSTRUCTION MANUAL

Thank you for purchase of “SJ2-CO (CANopen Interface Option)”. This manual explains about treatment of “SJ2-CO”. By reading this manual and an instruction manual of inverter use practically for installation, maintenance, and inspection. After reading this manual, keep it handy for future reference.

Make sure to deliver this manual to the end user.

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After reading this manual, keep it at handy for future reference.

NB654X

HITACHI

- Request -

Thank you for purchase of “SJ2-CO (CANopen Interface Option)”.

This instruction manual explains about treatment and maintenance of “SJ2-CO”. Before using the product, carefully read this manual with the instruction manual of inverter, and keeps it handy for quick reference of operator and maintenance inspector. Before installing, operating, maintenance and inspection read this manual carefully and follow the instructions exactly.

Always keep various kinds of specifications mentioned in this manual and use exactly. And make sure to prevent trouble by correct inspection and maintenance. Make sure to reach this manual to the end user.

- About treatment of this manual -

(1)Please consent that mentioned items of this manual may be change without permission.

(2)Keep this manual carefully not to lose because it can not be reissued

(3)All right reserved.

(4)Please contact the Hitachi inverter dealer from whom you purchased the unit, if you have some doubts about spelling mistakes, omitted word etc.

(5)Please agree that there is no responsibility for effects resulted, in spite of contents above mentioned.

Revision History Table

No.	Revision contents	The date of issued	Manual No.
1.	Initial release of Manual NB654X	June. 2006	NB654X

Except this table, revised only spelling mistakes omitted words, and error writings without notice.

SAFTY PRECAUTIONS

Carefully read this manual and all of the warning labels attached to the inverter before installing, operating, maintaining, inspecting, it. Safety precautions are classified into “Warning” and “Caution” in this manual.

⚠WARNING : Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

⚠CAUTIO : Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serous damage to the product

The situation described in ⚠CAUTION may, if not avoided, lead to serious results. Important safety measures are described in CAUTION (as well as WARNING) so be sure observe them.

Notes are described in this manual in “(Note)”. Carefully read the contents and follow them exactly.

⚠CAUTION

In all the illustrations in this manual, covers and safely device are occasionally removed to describe the details. When the product is operated, make sure that the covers and safety devices are placed as they were specified originally and operate it according to the instruction manual.

⚠ WARNING

Wiring:
Wiring work shall be carried out by electrical experts.
Otherwise, there is a danger of electric shock, fire and/or damage of product.
Implement wiring after checking that the power supply is off.
Otherwise, there is a danger of electric shock and/or fire.

Operating:
Be sure not to touch the surface or the terminal of option board while energizing.
Otherwise, there is a danger of electric shock and/or fire.
Be sure not to remove the Canopen option printed board while operating.
Otherwise, there is a danger of electric shock and/or fire.

Maintenance, Inspection and Part Replacement:
Wait at least 5 minutes after turning off the input power supply before performing maintenance and inspection.
(Make sure the “POW” LED display on the inverter is off and DC voltage between P-N terminals is less than 45V)
Otherwise, there is a danger of electric shock.
Make sure that only qualified persons will perform maintenance, inspection, and part replacement
(Before starting the work, remove metallic objects from your person (wristwatch, bracelet, etc.). Be sure to use tools protected with insulation.)
Otherwise, there is a danger of electric shock and/or injury.

Note:
Never modify the unit.
Otherwise, there is a danger of electric shock and/or injury.

⚠ CAUTION

Installation:
Be sure not to let the foreign matter enter such as wire clippings, spatter from welding, metal shaving, dust etc.
Otherwise, there is a danger of fire.
Be sure to fix inverter to option printed board with an attached fixed screw.
Otherwise, there is a danger of connecting error.
Be sure to fasten the screws connecting signal wire in side of option printed board. Check for any loosening of screw.
Otherwise, there is a danger of connecting error.

Wiring:
Be sure to fasten the screws not to loose.
Otherwise, there is a danger of connecting error.

Operation:
Check rotary direction, abnormal motor noise and vibrations during operating.
Otherwise, there is a danger of injury to personnel and/or machine breakage

1.1 INSPECTION UPON UNPACKING

Make sure to treat the product carefully not to give shock and vibration while unpacking. Check that the product is the one you ordered, no defect, and that there is no damage during transportation.
(Contents of packing)

(1) SJ2-CO(CANopen Interface option):1
(2) Instruction manual:1
(3) CANopen connector:1
(4) The screw which fixes a facecover (M3 times 8 mm):1
(5) Bus resister(120Ω):1

If you discover any problems, contact the Hitachi inverter dealer from whom you purchased the unit immediately.

1.2 INQUIRY OF THE PRODUCT AND WARRANTY FOR THE PRODUCT

1.2.1 Request upon inquiring

If inquiry of breakage, question, damage etc. is needed, please tell the following information to the supplier you ordered.

(1) Type(SJ2-CO)
(2) Manufacturing number (MFG No. (See 1.5 SJ2-CO Specifications Label))
(3) Date of purchasing
(4) Contents of inquiry
- Damage parts and its condition etc.
- Question parts and their contents etc.

In order to shorten impossible working time, standing spare unit is recommended.

1.2.2 Warranty of the product

This product is guaranteed one year after the purchase. But, the next case is toll repair, even if within warranty period.

(1) In case caused by operating mistake, and incorrect repair and modification.
(2) Trouble caused by reasons except the shipped product.
(3) In case of using in range over the value of specifications.
(4) In case caused by natural calamity, disaster, and secondary disaster.

Warranty mentioned here means warranty for shipped product itself. Damage caused by trouble of shipped product is not guaranteed.

[Replacement]
Any inspection and replacement after the expiration of warranty period (one-year) shall be charged to the purchaser. And also any inspection and replacement which are not covered in warranty mentioned above, even if it is within warranty period, it shall be charged to the purchaser. If you require the replacement, please contact the Hitachi inverter dealer from whom you purchased the unit.

1.3 Appearance and Names of Parts

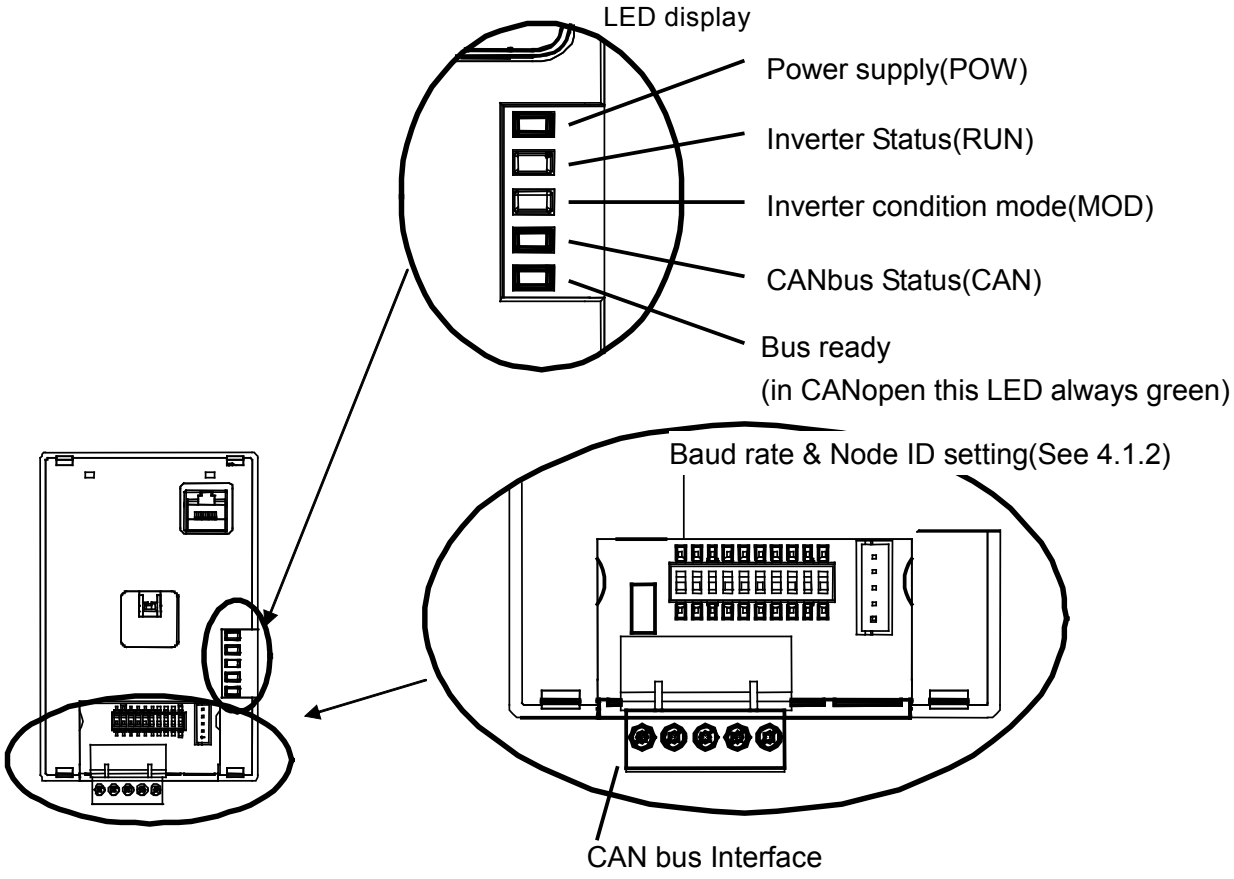


Figure 1-1 Appearance of SJ2-CO

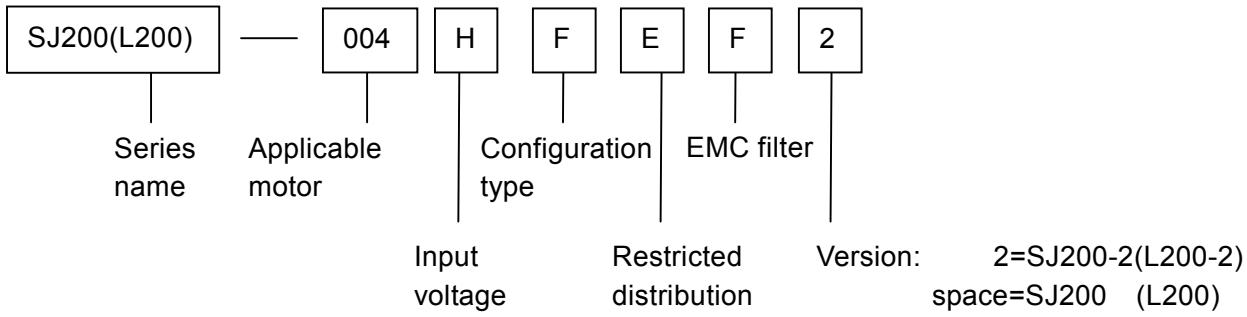
1.4 CANopen Support Version

SJ2-CO can use following Inverter model of SJ200-2/L200-2.

SJ200-2 -0.2-7.5kW

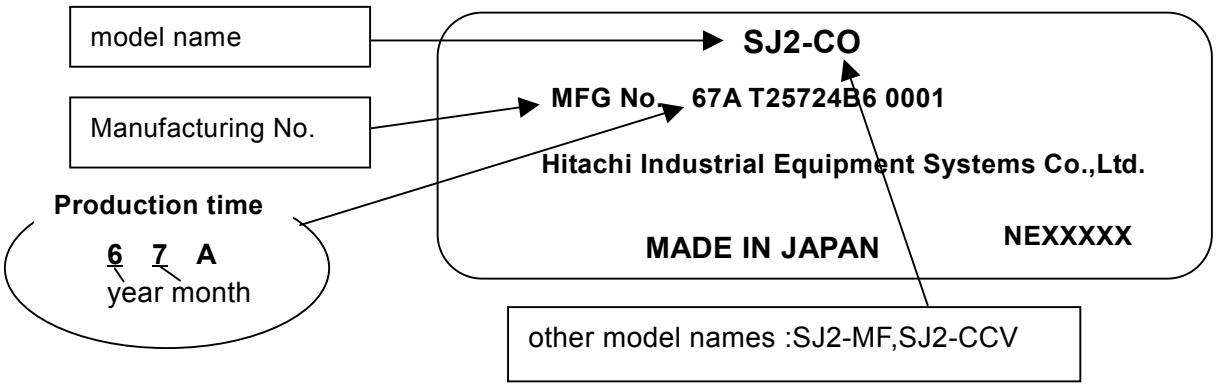
L200-2 -0.2-7.5kW

How to distinguish SJ200-2(L200-2) from SJ200(L200)



1.5 Specifications Label

There is the Specifications Label of SJ2-CO on the back side.



1.6 LED display

LED Function	Color	State
Power Supply	Orange	Inverter Main power supply is ON.
	Blank	Both power supplies are OFF.
Inverter Status	Red	Alarm or Inverter main power supply is OFF.
	Green	Run
	Stop	Stop (Normal)
Inverter condition mode(MOD)	-	See 6.4 LED display and Countermeasure
CAN condition/status(CAN)	-	See 6.4 LED display and Countermeasure
CAN bus power supply(DC+24V) (Internal power supply)	Green	ON
	Blank	OFF

2.1 Mounting method of option

Please connect the following cables first, and then attach the SJ2-CO to the front cover of SJ/L200-2.
[Installation step]
(1) mounting location
(2) Change the dipswitch position to lower (OPE)
(3) Connecting the cables
The cables are shown as bellow:
Power input cable, Motor output cable, Input terminal cable, Output terminal cable, Analog input cable, Analog output cable etc
Because the following cables cannot be connected, after the instllation of SJ2-CO.

Figure 2-1 describes how to mount the SJ2-CO to the SJ200-2.
Figure 2-2 describes how to mount the SJ2-CO to the L200-2.
Figure 2-3 describes how to remove the SJ2-CO to the SJ200-2.
Figure 2-4 describes how to mount the SJ2-CO and operator(OPE-SRmini) to the SJ200-2

Note: Optional operator
(SRW-0J/0EX) cannot be used via SJ2-CO.

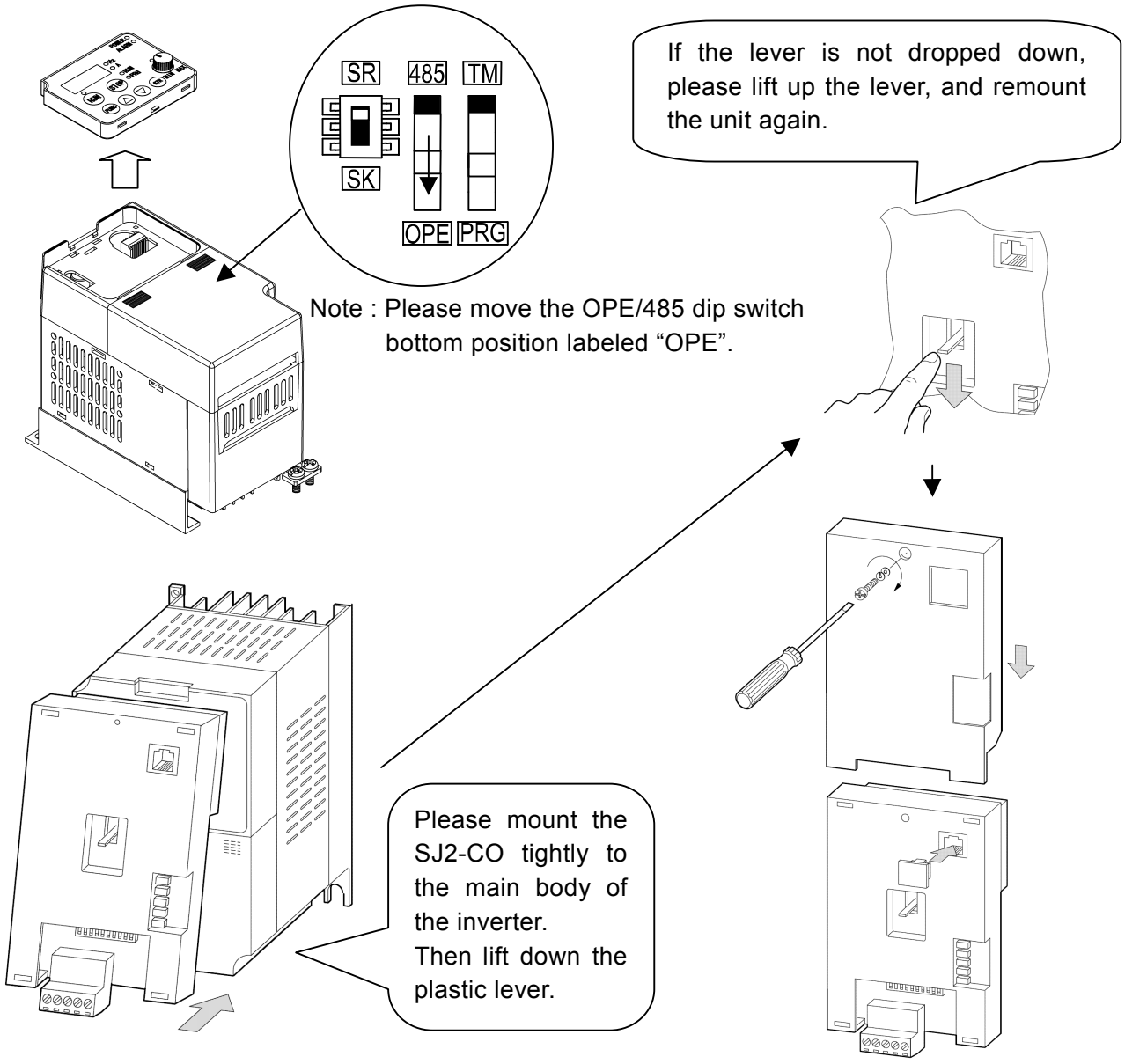
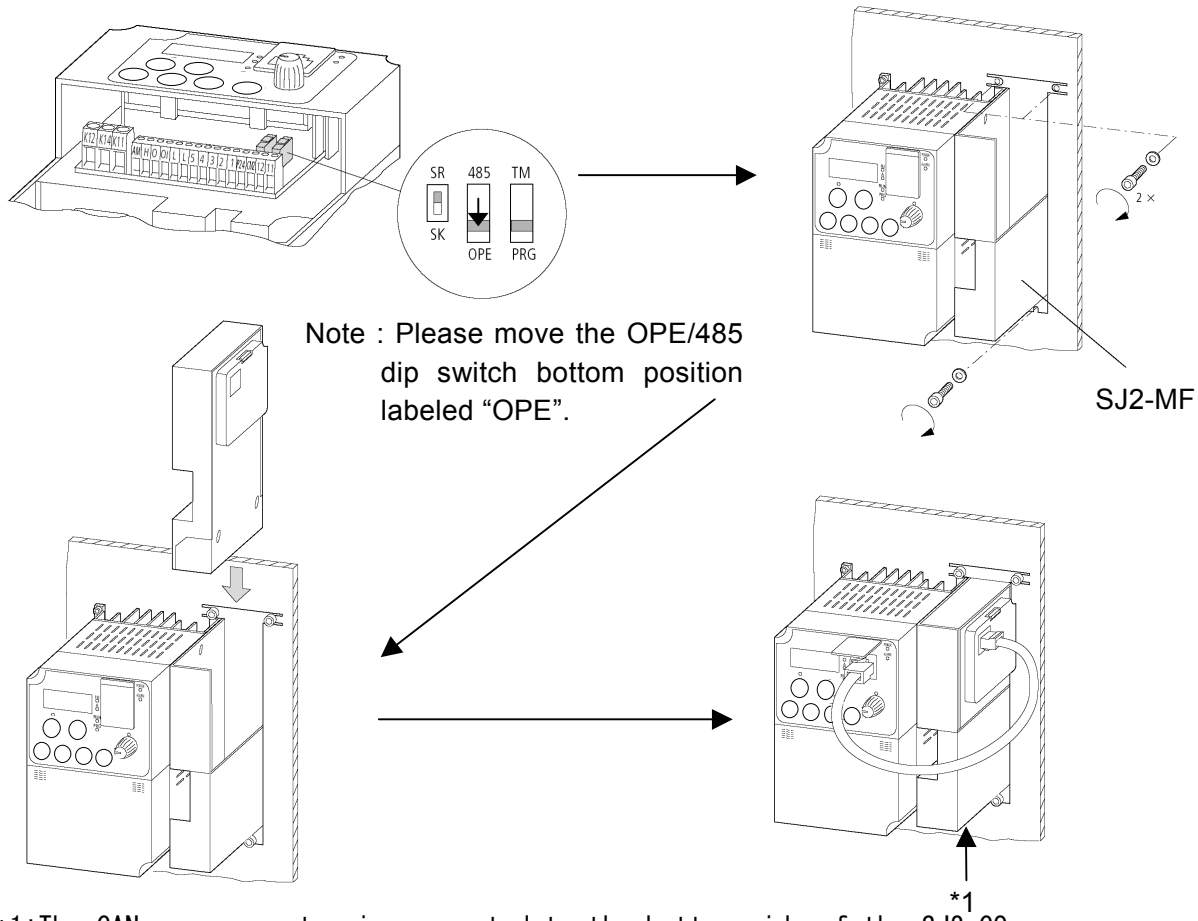

SR
485
TM
SK
OPE
PRG
Note : Please move the OPE/485 dip switch bottom position labeled “OPE”.
If the lever is not dropped down, please lift up the lever, and remount the unit again.
Please mount the SJ2-CO tightly to the main body of the inverter.
Then lift down the plastic lever.

Figure 2-1 Installation of SJ2-CO (SJ200-2 + SJ2-CO)



*1:The CANopen connector is connected to the bottom side of the SJ2-CO
SJ2-MF Specifications Label: See 1.5 Specifications Label

Figure 2-2 Installation of SJ2-CO (L200-2 + SJ2-CO + SJ2-MF)

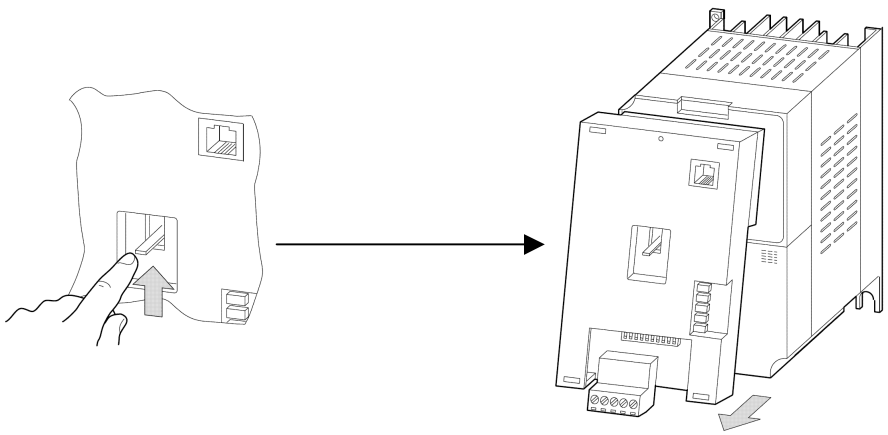
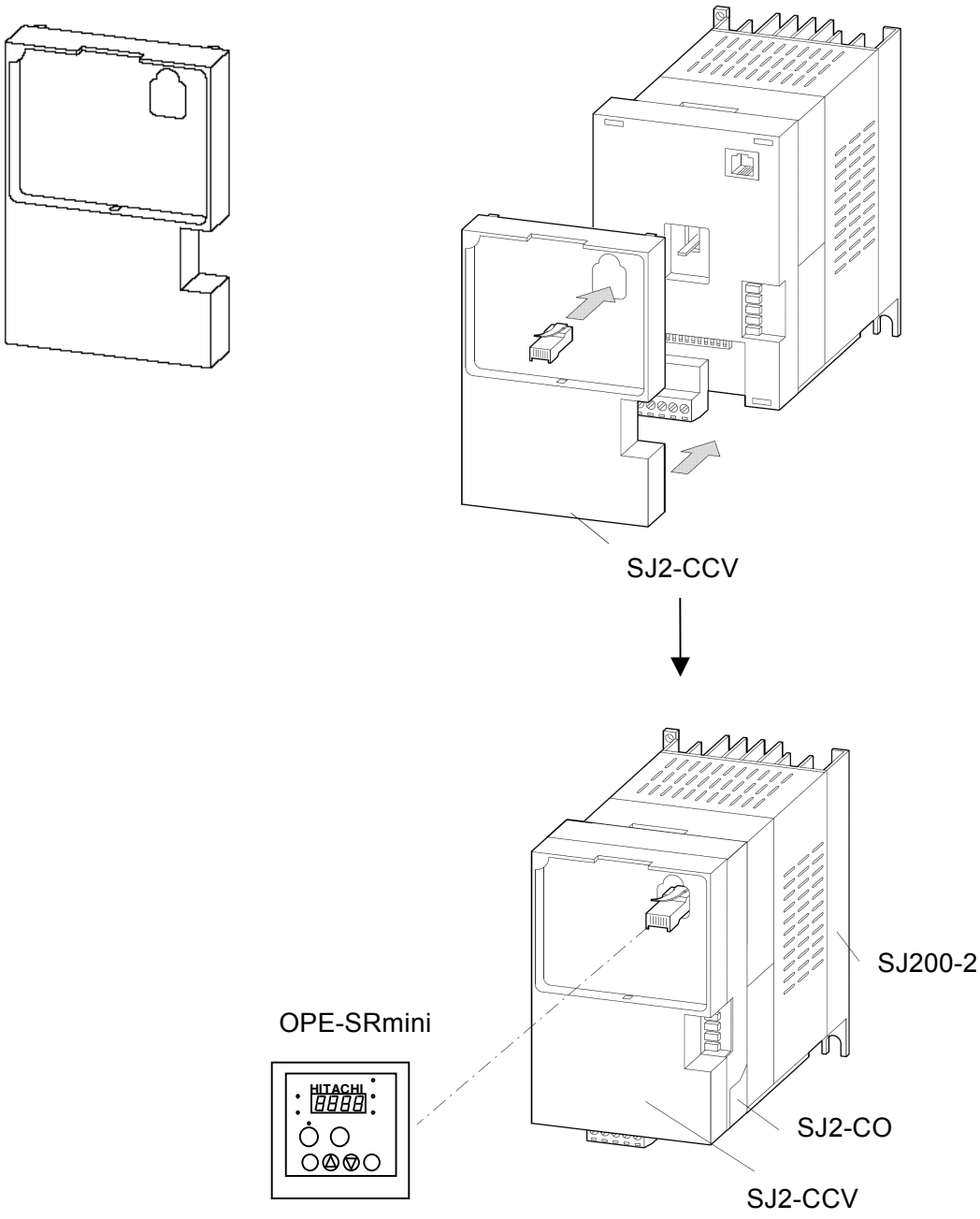


Figure 2-3 Remove of SJ2-CO (SJ200-2 + SJ2-CO)

SJ2-CCV (Optional)



SJ2-CCV Specifications Label: See 1.5 Specifications Label

Figure 2-4 Installation of option unit (SJ200-2 + SJ2-CO + SJ2-CCV)

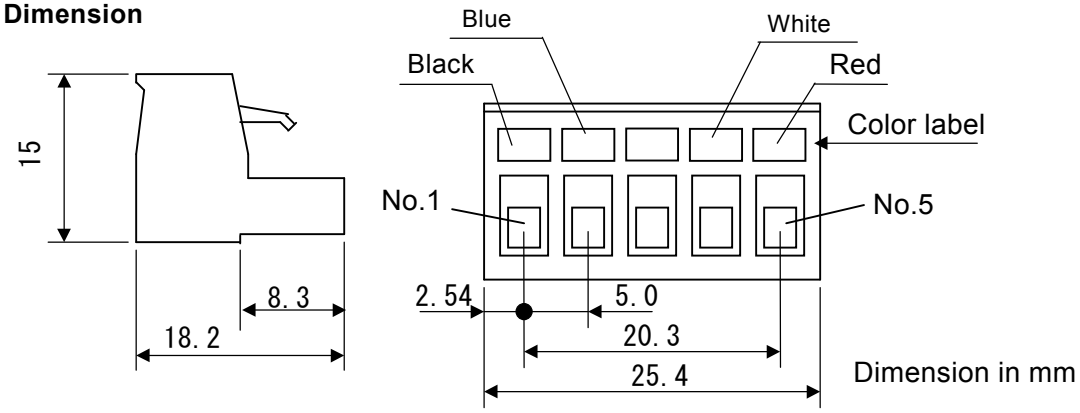
3.1 Connection for CANopen connector

SJ2-CO has a Pluggable open connector (Male contacts), and a Network connector (Female contacts) attached. The inverter and attach connector have a seal which is color coordinated to correspond to the network cable. Ensure the cable and contact are wired in the same color cable.

Cable side connector (attached connector)

Maker	Type
Phoenix contact co, Ltd.	MSTB 2.5/5ST-5.08 AU

Dimension



Wiring of CANopen Communication connector

No.	Signal mark	Type of signal	Cable color
1	Ground	Internal power supply(-)	Black
2	CAN_L	CAN L bus line(dominant low)	Blue
3	DRAIN	Optional CAN shield	Bare
4	CAN_H	CAN H bus line(dominant high)	White
5	NC	No connect	Red

Figure 3-1 Connector specifications

Note:Communication power supply(DC 24V) of SJ2-CO is not required.
Please don't make a short circuit between PIN 1(Black) and 5(Red).

3.2 Communication cable for CANopen

Use the connector which conforms to CANopen specifications or five conductor cable and also make sure that cable, connector and Network distance conform to CANopen specifications.

Baud rate(kbps)	Maximum Bus length(m)
1000 (1M)	25
800	50
500	100
250	250
125	500
50	1000
20	2500
10	5000

3.3 Wiring note

1.Installing the cable to Network connector must be done after checking the power supply off and “POW” LED is “OFF”.
2.Wiring should not have bare cables exposed between connector contacts.
3.Network cables should be fixed without tension. Cables fixed under tension have potential of causing a communication fault by to be removed a connector.
4.A terminating resistor is not built-in the unit. Please use the accessory of Bus resister(120Ω).
5.Ensure external emergency stop measures are taken to stop the inverter, in the event of a network fault.
(a) Remove the Power supply of the Inverter when the network master detects a communication fault.
(b) When the master detects a communication fault, turn on the intelligent input terminal which would be allocated (FRS), (RS) and/or (EXT) function.
(c) Setting command P045 to except “02”.
In this setting, the inverter is tripped, deceleration or free run stop when it detects a communication fault itself. (Factory initialization of command P045 is trip after deceleration stop (code: 01).)
See “4.2 Setting of the Inverter”.
6.Basic components for construction of CANopen application are shown bellow.
Refer to the master’s description manuals when CANopen Network system comes into operation.

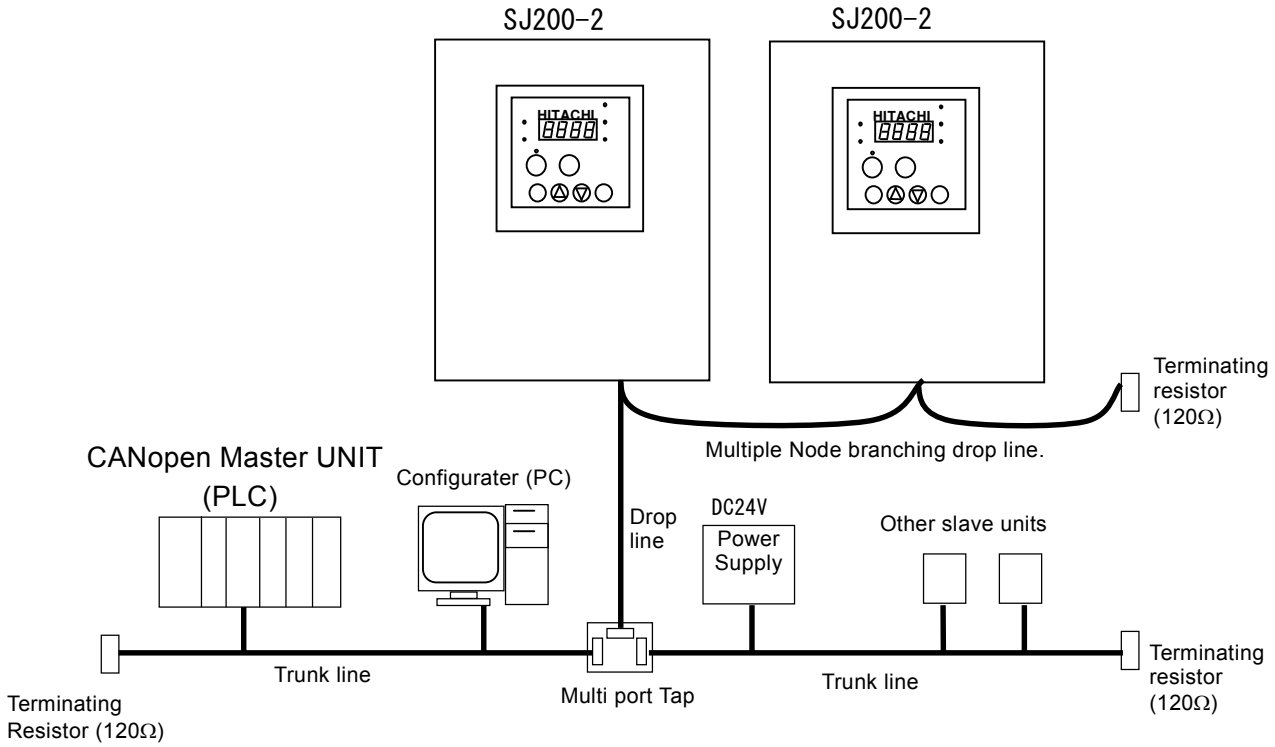


Figure 3-2 Example of components for construction of CANopen application

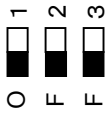
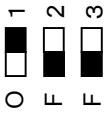
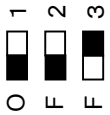
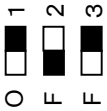
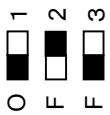
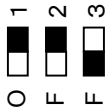
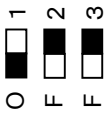
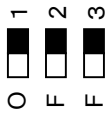
Note:Communication power supply(DC 24V) of SJ2-CO is not required.
Please don’t make a short circuit between PIN 1(Black) and 5(Red).

4.1 Setting methods of Baud rate and Node ID

Follow the procedure below to set Baud rate in CANopen and Node ID, reset the power supply after changing the setting (setting will be reflected after resetting power supply.). Initial Baud rate: 125kbps, Initial Node ID: 2.

4.1.1 Setting method of CANopen Baud rate

The table below is setting method of Baud rate with Dip switch.

Baud rate (kbps)	Dip switch Setting	Note	Baud rate (kbps)	Dip switch Setting	Note
10		For bus length greater than 1km bridge or repeater device may be needed.	250		
25			500		
50			800		
125			1000		

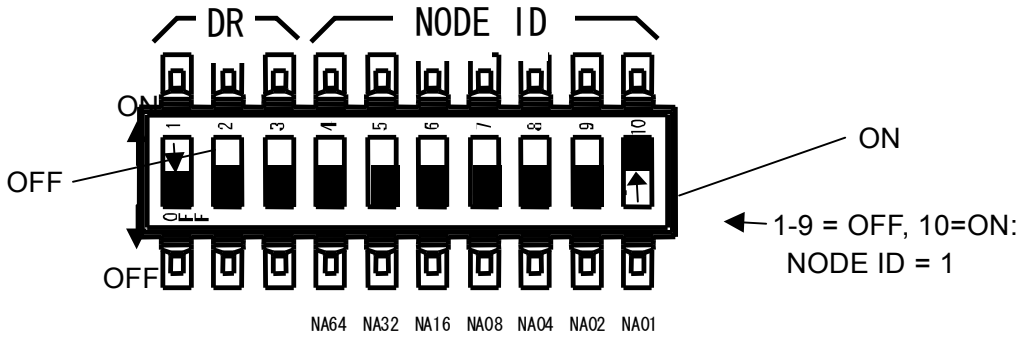
1=OFF 2=ON 3=ON

4.1.2 Setting method of CANopen Node

Figure left describes the direction of Dip Switches. See below

ON: 1 OFF: 0

Bit increases from right to left switches. Figure formula below.



NODE ID = $NA64*2^6+ NA32*2^5+ NA16*2^4+ NA08*2^3+ NA04*2^2+ NA02*2^1+ NA01*2^0$

4.2 Parameter setting of the Inverter

Following table describes setting items relate SJ200-2/L200-2 series Inverter with connecting SJ2-CO.
Following parameter will appear with connecting SJ2-CO to SJ200-2/L200-2 Inverter.

Parameter	Function	Range of DATA	Initial DATA	Note
P044	Timer setting of Communication timeout Whilst running	0.00~99.99	0.00	**
P045	Inverter action when communication error	00(TRIP) / 01(TRIP after deceleration stop) / 02(ignore) / 03(Free-RUN) / 04(deceleration stop)	01	It is effective when "Object #6007" setting is '-3'.
P049*	Motor Poles setting for revolution per minutes	0 to 38 (It is possible to set only even number) Setting value '0', monitoring unit is Hz. Setting value except '0', monitoring unit is min^{-1}.	0	

Note*: As "P049 Command" value is setting '0', unit of "Index 6042,6043,6044,6046,6048-1,6049-1" is 'Hz'.

Note**: CANopen Interface Option cannot detect bus-off status with heartbeat. Using P045 command, set value of P044 instead of detecting bus-off status.

4.3 Power Supply LED check

If the Power Supply LED(See 1.3) is not ON ,please remount(See 2.1) the SJ2-CO unit again.

5.1 Feature of CANopen communication function

5.1.1 SDO(Service Data Object)

When using the segmented SDO download and upload services, the communication software will be responsible the SDO as a sequence of segments.

Explicit transfer has to be supported. Segmented transfer has to be supported if objects lager than 4 bytes are supported. Optionally the following SDO services for doing a block transfer with higher bus utilization and performance for large data set size can be implemented.

The model for the SDO communication is the Client/Sever model.

CANopen Interface Option uploads and downloads inverter parameters using Object Dictionary 1200h.

Sub-Index	Type	Meaning	Notes
0	UNSIGNED8	Number of supported entries in the record	default: 2
1	UNSIGNED32	COB-ID Client -> Server (Receive ID)	
2	UNSIGNED32	COB-ID Server -> Client (Transmit ID)	

Abort Code

This protocol is used to implement the abort SDO Transfer Service.

The abort code is standard code of CANopen specifications.

Abort code	Description	Notes
0503 0000h	Toggle bit not alternated.	
0504 0000h	SDO protocol time out.	
0504 0001h	Client/server command specifier not valid or unknown.	
0504 0005h	Out of memory.	
0601 0000h	Unsupported access to an object.	
0601 0001h	Attempt to read a write only object.	
0601 0002h	Attempt to write a read only object.	
0602 0000h	Object does not exist in the object dictionary.	
0604 0041h	Object cannot be mapped to the PDO.	
0604 0042h	The number and length of the objects to be mapped would exceed PDO length.	
0604 0043h	General parameter incompatibility reason.	
0606 0000h	Access failed due to an hardware error.	
0607 0010h	Data type does not match, length of service parameter does not match	
0607 0012h	Data type does not match, length of service parameter too high	
0607 0013h	Data type does not match, length of service parameter too low	
0609 0011h	Sub-index does not exist.	
0609 0030h	Value range of parameter exceeded (only for write access)	
0609 0031h	Value of parameter written too high.	
0609 0032h	Value of parameter written too low.	
0609 0036h	Maximum value is less than minimum value.	
0800 0000h	general error	
0800 0020h	Data cannot be transferred or stored to the application.	
0800 0021h	Data cannot be transferred or stored to the application because of local control.	
0800 0022h	Data cannot be transferred or stored to the application because of the present device state.	
0800 0023h	Object dictionary dynamic generation fails or no object dictionary is present (e.g. object dictionary is generated from file and generation fails because of an file error).	

5.1.2 PDO(Process Data Object)

The real-time data transfer is using the PDOs.

There are two kinds of PDO transmission modes. One is a synchronization (SYNC), the other is asynchronization message (Remotely Request, Event Driven, Timer Driven).

These PDO services use the push / pull models. The PDOs have Transmit-PDOs (maximum data size is 8 bytes) and Receive-PDOs (maximum data size is 8 bytes). These data type and these mapping are defined by the Object Dictionary.

The following table is the PDO parameter indexes, the data types and the objects.

Index	Type	Object	Notes
1400h	20h	1st receive PDO communication parameter	
1401h	20h	2nd receive PDO communication parameter	
1402h	20h	3rd receive PDO communication parameter	
1403h	20h	4th receive PDO communication parameter	
1600h	21h	1st receive PDO mapping parameter	
1601h	21h	2nd receive PDO mapping parameter	
1602h	21h	3rd receive PDO mapping parameter	
1603h	21h	4th receive PDO mapping parameter	
1800h	20h	1st transmit PDO communication parameter	
1801h	20h	2nd transmit PDO communication parameter	
1802h	10h	3rd transmit PDO communication parameter	
1803h	20h	4th transmit PDO communication parameter	
1A00h	21h	1st transmit PDO mapping parameter	
1A01h	21h	2nd transmit PDO mapping parameter	
1A02h	21h	3rd transmit PDO mapping parameter	
1A03h	21h	4th transmit PDO mapping parameter	

Data type “20h” is a record, which defines the PDO communication parameter, and it is of the following format:

Sub-Index	Type	Meaning	Notes
0h	UNSIGNED8	Number of supported entries in the record	Default: 2
1h	UNSIGNED32	COB-ID	
2h	UNSIGNED8	transmit type	Default: 255
3h	UNSIGNED16	inhibit time	TPDO only
4h	UNSIGNED8	CMS priority group	Default: 3

Data type “21h” is a record, which defines the PDO mapping parameter and it is of the following format:

Sub-Index	Type	Meaning	Notes
0h	UNSIGNED8	Number of supported entries in the record	Default: 2
1h or 1h, 2h	UNSIGNED32	Structure consisting of mapped object index (16 bit), sub-index (8 bits) and object data length in bits. For example “20010010h” defines object “2001h”, sub-index “0h”, and data length of16 bits (=word).	

5.1.3 Device Control

CAN open interface option can use "Velocity Mode" DSP-402 V2.0 drive control profile.

5.1.4 Object Dictionary for Standardized Device Profile Area

CAN open interface option is supported following objects.

Index	Meaning	Type
6007h	abort_connection_option_code	Integer16
6040h	control word	Unsigned16
6041h	status word	Unsigned16
6042h	vl_target_velocity	Integer16
6043h	vl_velocity_demand	Integer16
6044h	vl_control_effort	Integer16
6046h	vl_velocity_min_max_amount	Unsigned 32
6048h	vl_velocity_acceleration	Ramp
6049h	vl_velocity_deceleration	Ramp
6060h	modes_of_operation	Integer8
6061h	modes_of_operation_display	Integer8

5.1.5 abort_connection_option_code (Index: 6007h)

When communications between CANopen interface option and HOST cannot be active, inverter actions will decide following this object setting.

value	Action	Notes
0	No action	Same as"P045 setting value 02”
1	No action	Same as"P045 setting value 02”
2	Disable voltage-(FRS)	Same as"P045 setting value 03”
3	Quick stop (Deceleration with 2nd setting)	
-3	manufacturer specific: Enable switch for “P045 setting”.	Enable P045 setting. See 5.1.5 Parameter setting of SJ200
-4	No Action	
-5	No Action	

In new CANopen Interface Option, the trigger of this function is timer out in P044 instead of bus-off condition.

5.1.6 Control word (Index: 6040h)

The control word is used to send control commands to the inverter. (HOST-> Inverter)

Bit	Description	Note
0	Switch On－Stop	Mandatory
1	Disable Voltage－Free Run Stop	Mandatory
2	Quick stop－Stop using 2CH setting	Mandatory
3	Enable Operation－Run	Mandatory
4	RFG Enable	Mode Specific
5	RFG Unlock	Mode Specific
6	RFG Usr ref	Mode Specific
7	Reset Fault (raising edge)	Mandatory
8	Halt	Mode Specific
9	(Undefined)	Reserved
10	(Undefined)	Reserved
11	RDY Function Enable	Manufacturer Specific
12	NetRef	Manufacturer Specific
13	NetCtrl	Manufacturer Specific
14	Move forward	Manufacturer Specific
15	Move reverse	Manufacturer Specific

To use setting frequency from CANopen, please set bit NetRef(bit 12). An inverter parameter A001 is set 10(Calculate function output) with setting NetRef bit is 1, Calculate function output will not work.

To handle RUN/STOP command form CANopen, you have to set a bit NetCtrl.

5.1.7 Status word (Index: 6041h)

The status word indicates the current state of the inverter.

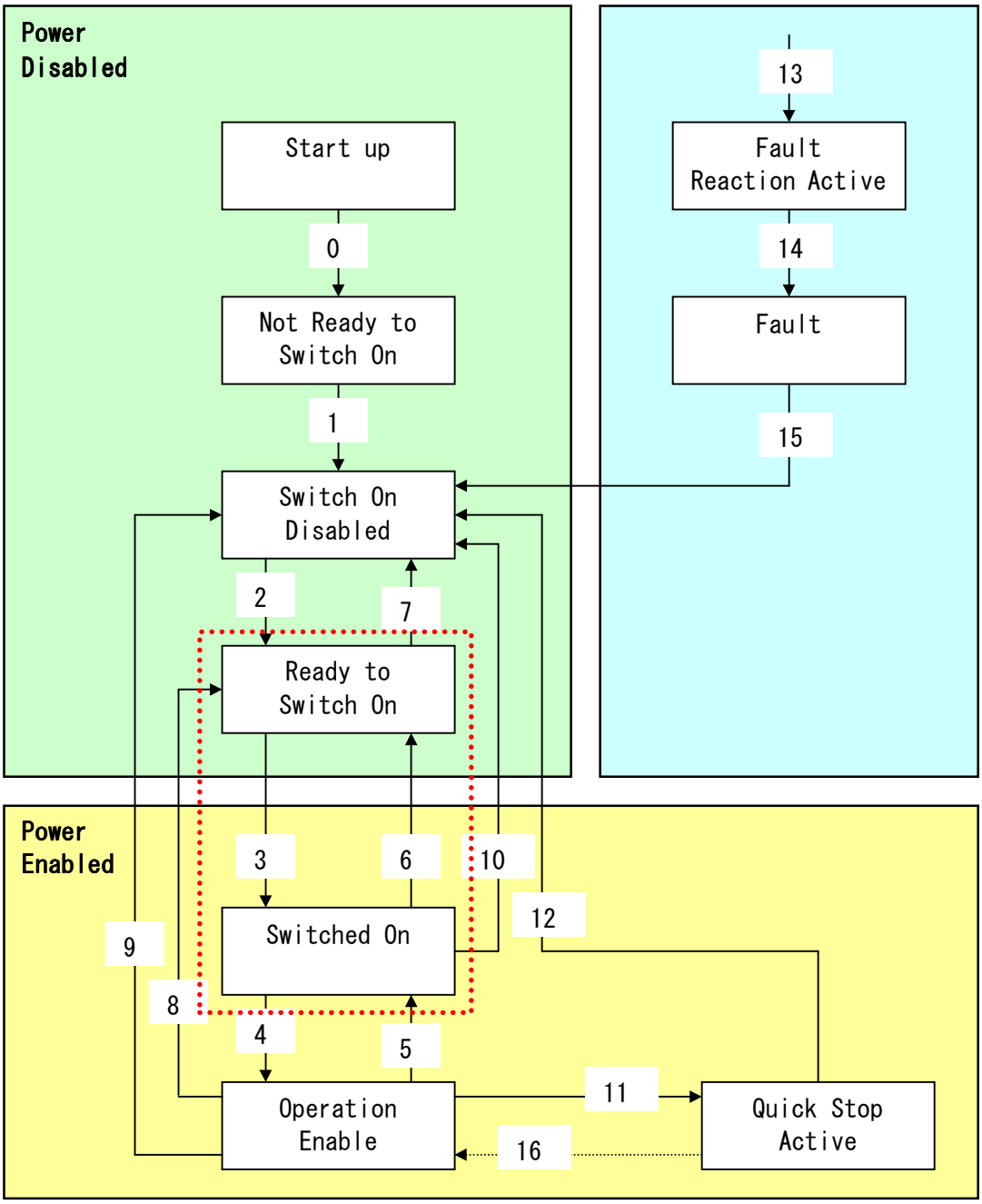
Bit	Description		Note
0	Ready to switch on		Mandatory
1	Switched on		Mandatory
2	Operation enabled		Mandatory
3	Fault		Mandatory
4	Voltage enabled	(~V1.04) Voltage disable -> enabled	Mandatory
5	Quick stop		Mandatory
6	Switch on disabled		Mandatory
7	Warning		Unsupported
8	Manufacturer Specific		Unsupported
9	Remote		Mandatory
10	Target reached		Mandatory
11	Internal Limit Active	“Index 6046” influences this bit.	Mandatory
12	(reserved)	(reserved)	Mode Specific
13	(reserved)	(reserved)	Mode Specific
14	Moving forwards		
15	Moving backwards		

Bitmapping of Status word

Inverter	Bit 6	Bit 5	Bit 3	Bit 2	Bit 1	Bit 0
	Switch On Disable	Quick Stop	Fault	Operation Enable	Switch On	Ready to Switch On
Not Ready to Switch On	0	X	0	0	0	0
Switch On Disabled	1	X	0	0	0	0
Ready to Switch On	0	1	0	0	0	1
Switched On	0	1	0	0	1	1
Operation Enabled	0	1	0	1	1	1
Fault	0	X	1	1	1	1
Fault Reaction Active	0	X	1	1	1	1
Quick Stop	0	0	0	1	1	1

‘X’ means that any value is allowed.

5.1.8 State Machine

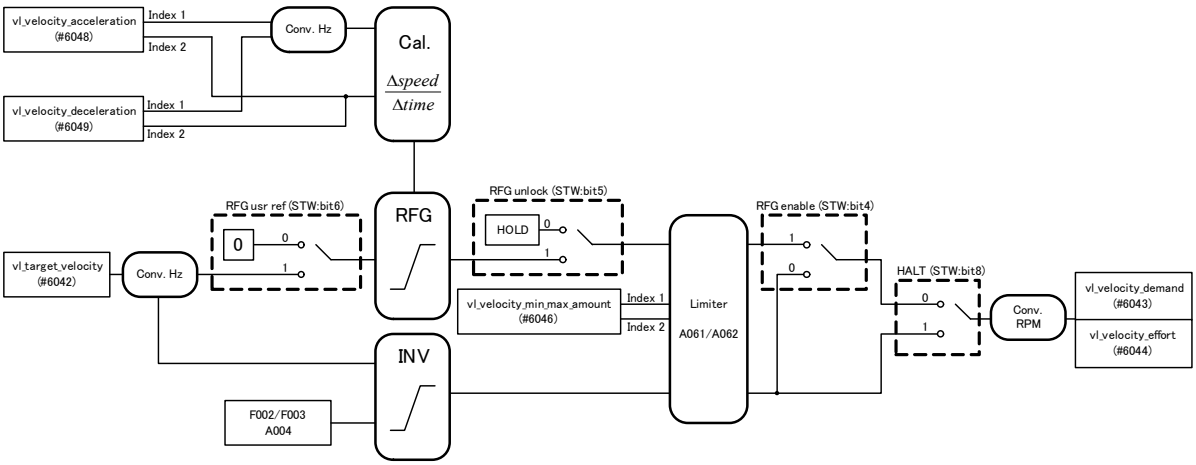


Command bit of Control word	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	Transition
	Fault Reset	Enable Operation	Quick Stop	Disable Voltage	Switch On	
Shutdown	0	X	1	1	0	2,6,8
Switch On	0	X	1	1	1	3
Disable Voltage	0	X	X	0	X	7,9,10,12
Quick Stop	0	X	0	1	X	7,10,11
Disable Operation	0	0	1	1	1	5
Enable Operation	0	1	1	1	1	4,16
Fault Reset	0 -> 1	X	X	X	X	15

'X' means that any value is allowed.

5.1.9 Using RFG(Ramp Function Generator)

Purpose of using RFG is selecting RAMP (frequency generator) sources. The method of selecting RAMP sources is using STW. It is shown diagram below.



If you use RFG, Please set parameter shown below.

B021(Overload restriction operation mode)	00(OFF)
B130(Over-Voltage LADSTOP enable)	00(OFF)
B140(Over-current trip suppression)	00(OFF)

In purpose of setting parameter above, these parameters are automatically decelerated output velocity in condition of these functions. It is not satisfied that specifications of CANopen. In selecting RFG mode, it doesn't work the functions Overload restriction, Over-Voltage LADSTOP and Over-current trip suppression. When you want to use these functions, please don't select RFG mode.

5.1.10 vl_target_velocity (Index: 6042h)

The vl target velocity is the required velocity of the system. It is multiplied the vl dimension factor and the vl set-point factor, if these are implemented.

Inverter parameter = output frequency setting (Multi-speed0) (A020)
(unit: min^{-1} Minimum unit: 1dig= $1min^{-1}$)

5.1.11 vl_velocity_demand (Index: 6043h)

The vl velocity demand is the instantaneous velocity provided by ramp function, scaled to the unit of the vl target velocity.

Inverter parameter = output frequency monitor (d001)
(unit: min^{-1} Minimum unit: 1dig= $1min^{-1}$)

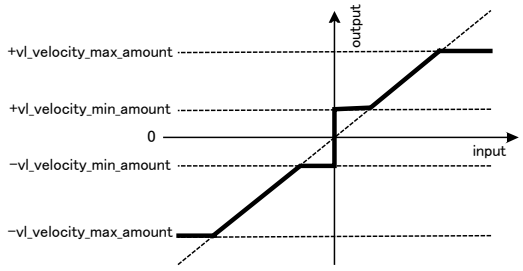
5.1.12 vl_velocity_effort (Index: 6044h)

The vl velocity effort is the velocity at the motor spindle or load, scaled to the unit of the vl target velocity.

(unit: min^{-1} Minimum unit: 1dig= $1min^{-1}$)

5.1.13 vl_velocity_min_max_amount (Index: 6046h)

The vl velocity min-max amount index is composed of the vl velocity min(Sub-index1) amount and vl velocity max(sub-index2) amount sub-index. (32bit length)
Sub-index1 = 1st frequency minimum limiter (A062)
Sub-index2 = 1st frequency maximum limiter (A061)
(unit: min^{-1} Minimum unit: 1dig= $1min^{-1}$)



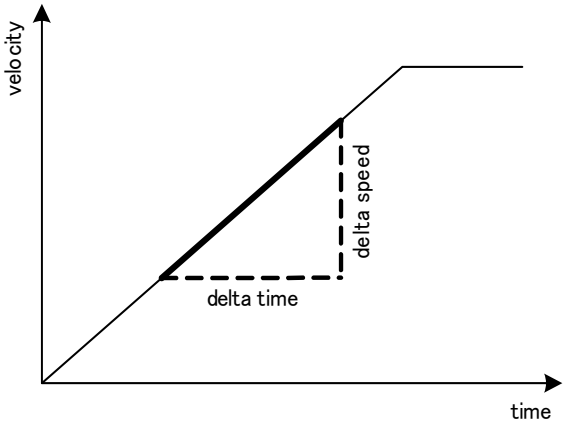
5.1.14 vl_velocity_acceleration (Index: 6048h)

The vl velocity acceleration index specifies the slope of acceleration ramp for RFG. (32bit length)
It is generated as the quotient of the delta speed(Sub-index1) and delta time(sub-index2) sub-index.

Sub-index1 = delta speed (unit: min^{-1} Minimum unit: 1dig= $1min^{-1}$)
Sub-index2 = delta time (unit: sec Minimum unit: 1dig= 1sec)

vl_velocity_acceleration = delta_speed / delta_time

This Index is effective only RFG mode.



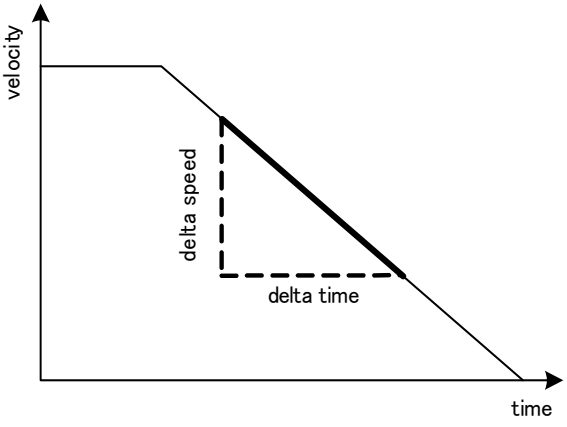
5.1.15 vl_velocity_deceleration (Index: 6049h)

The vl velocity deceleration index specifies the slope of deceleration ramp for RFG. (32bit length)
It is generated as the quotient of the delta speed(Sub-index1) and delta time(sub-index2) sub-index.

Sub-index1 = delta speed (unit: min^{-1} Minimum unit: 1dig= $1min^{-1}$)
Sub-index2 = delta time (unit: sec Minimum unit: 1dig= 1sec)

vl_velocity_acceleration = delta_speed / delta_time

This Index is effective only RFG mode.

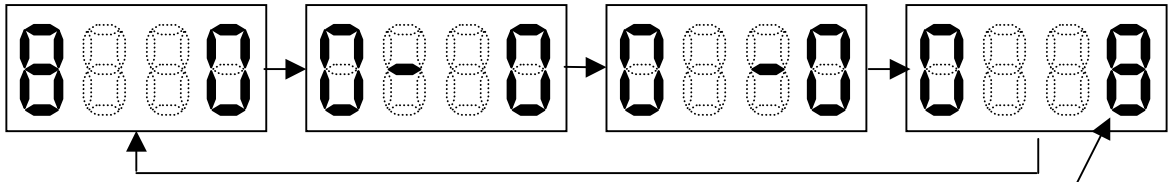


5.1.16 modes_of_operation (Index: 6060h/6061h)

The actual mode is reflected in the modes of operation display (index 6061h), and not in the mode of operation(index 6060h). But CANopen Interface Option supported only Velocity Mode. These objects are always stored “2(Velocity mode)”.

5.2 Keypad display(OPTIONAL OPERATOR:OPE-SRMINI)

In status of initializing CANopen option, the keypad shows following display.



Black:Segment is “ON”

Note: This display appears during initializing which is follow conditions;

- Initializing with b084
- Trip reset
- CANopen option initializing when power is lunched.
- “RS” terminal is lunched up.
- Occurring un-expected matter.

6.1 Trip display

When the inverter is in a tripped state, the inverter displays an error code (See table below). The trip history monitor (d081 to d086) also displays the same error code as the inverter.

6.2 Protection function list

The table below describes an error code for protecting the inverter and the motor.

No.	Function	Error Display	Action
1	Network option's communication error	E70	This error is displayed, disconnection occurs when timeout is occurred, while the inverter is operating with CANopen. (Trip is caused by P045 setting)
2	External trip	E12	This error is displayed, when Halt is set to 1 toward control word(Index:6040h) in BIT8(Halt).

With regard to the other errors except table above, refer to Inverter instruction manual chapter 4 Explanation of function.

6.3 Countermeasure for a trip state

The table below only corresponds to additional trip codes, with regard to the other countermeasures refer to Inverter instruction manual chapter 4 Explanation of function.

Trip code	Name of trip	Cause	Conformation	Countermeasure
E70	CANopen Communication error	Baud rate is different.	Check Baud rate	Install correct Baud rate and then reset the power supply.
		Wiring distance does not match with Baud rate	Check the wiring distance	Adjust the setting to the matching Baud rate. Adjust Wiring distance.
		Defective connector for signal cable causes connection fail.	Check the area of connection.	Improve the connection and then reset the power supply.
		Terminating resistor is not connected.	Check the Connection	Connect the terminating Resistor and then reset the power supply
E12	External Trip	Control word(Index:6040h) Bit8:Halt	Check as mentioned left.	Set Halt to 0 toward Control word(Index:6040h)Bit8(Halt).

6.4 LED display and Countermeasure

Following states are indicated by Module LED and CANopen status LED.
MOD (Module status) LED: It indicates Inverter condition.
CAN (CANopen status) LED: it indicates CANopen status.

LED	Color	State	Countermeasure	Category
MOD	Green ON	The inverter is in Normal condition.	-	Mandatory
	Green single flash	The inverter is in Stand-by condition.	-	Mandatory
	Red ON	An abnormality occurred which is impossible to restore.	Need to fix the inverter.	Mandatory
	Red single flash	An abnormality occurred which is possible to restore. Mostly this state occurs, when the inverter is in trip condition. But except status below. User initializing with b084 set to 01 or 02.	When in trip, remove the trip causes. When initializing, the inverter starts up automatically the BOOTUP process after the initializing.	Mandatory
	OFF	Power off	-	Mandatory
CAN	Green ON	OPERATIONAL	-	Mandatory
	Green single flash	STOPPED	-	Mandatory
	Green Blinking	PRE-OPERATINAL	-	Mandatory
	OFF	no error	-	Mandatory
	Red single flash	Warning limit reached	Any Flaming error	Mandatory
	Red double flash	Error Control Event	The Guarding Protocol or the Heartbeat Protocol is processing.	Mandatory

notes

LED ON:
constantly on

LED OFF:
constantly off

LED blinking:
iso-phase on and off with a frequency of approximately 2.5Hz:
on for approximately 200ms and off for approximately 200ms.

LED single flash:
one short flash (approximately 200ms) followed by a long off phase (approximately 1000ms).

LED double flash:
a sequence of two short flashes (approximately 200ms),
separated by an off phase (approximately 200ms).
The sequence is finished by a long off phase (approximately 1000ms).

7.Communication Objects

Communication Objects are grouped 3 areas.

Index	Profile Area
1000-1FFF	Communication Profile Area
2000-5FFF	Manufacturer Specific Profile Area(Inverter's parameter area)
6000-9FFF	Device Profile Area

7.1 Device Profile Area

Supported Communication Object by CANopen interface option ( ) =initial value

Index	Sub-Index	Object name	Data type	Note
6007h		abort_connection_option_code	INTEGER16	*
6040h		control word	UNSIGNED16	*
6041h		status word	UNSIGNED16	*
6042h		vl_target_velocity	INTEGER16	*
6043h		vl_velocity_demand	INTEGER16	*
6044h		vl_control_effort	INTEGER16	*
6046h		vl_velocity_min_max_amount	UNSIGNED32	
	0	Number of entries(=2)	INTEGER8	*
	1	vl_velocity_min_amount	UNSIGNED16	*
	2	vl_velocity_max_amount	UNSIGNED16	
6048h		vl_velocity_acceleration	Ramp	
	0	Number of entries(=2)	INTEGER8	*
	1	delta_speed	UNSIGNED16	*
	2	delta_time	UNSIGNED32	*
6049h		vl_velocity_deceleration	Ramp	
	0	Number of entries(=2)	INTEGER8	*
	1	delta_speed	UNSIGNED16	*
	2	delta_time	UNSIGNED32	*
6060h		modes_of_operation	INTEGER8	*
6061h		modes_of_operation_display	INTEGER8	*

Note : This object cannot store to EEPROM.

7.2 Profile Manufacyure Objects (d,F group)

INDEX	Parameter	Function Name	Size	Unit	Note
0x2001	d001	Output frequency monitor	2	0.1Hz	
0x2002	d002	Output current monitor	2	0.1%	*1
0x2003	d003	rotation direction monitor	1	-	
0x2004	d004	PID feedback monitor	4	0.01%	
0x2005	d005	Intelligent input terminal status	1	-	
0x2006	d006	Intelligent output terminal status	1	-	
0x2007	d007	Frequency conversion monitor	4	-	
0x2013	d013	Output voltage monitor	2	0.01%	*2
0x2016	d016	Accumulated time monitor during RUN	4	1.hr	
0x2017	d017	Power ON time monitor	4	1.hr	
0x2080	d080	Number of trip time monitor	2		
0x2081	d081	-			
sub 0		Number of element = 2			
sub 1		Factor			
sub 2		Output frequency in TRIP			
0x20A1	-	-			
sub 0		Number of element = 3			
sub 1		Factor			
sub 2		Output current in TRIP			
sub 3		DC-bus voltage in TRIP			
0x20B1	-	-			
sub 0		Number of element = 2			
sub 1		Factor			
sub 2		RUN time			
0x20C1	-	-			
sub 0		Number of element = 2			
sub 1		Factor			
sub 2		ON time			
0x2202	F002	1st acceleration time	4	0.01sec	
0x2302	F202	2nd acceleration time	4	0.01sec	
0x2203	F003	1st deceleration time	4	0.01sec	
0x2303	F203	2nd deceleration time	4	0.01sec	
0x2204	F004	Keypad Run Key routing (Operation direction selection)	1	-	

Note *1: “d002 monitor” has to calculate shown below:
Output Current(A) = [“Value of Index 0x2002” * rated current(A)] / 100

Note *2: ”d013 monitor” has to calculate shown below:
Output Voltage(V) = [“Value of Index 0x2013” * Voltage class (200V or 400V)] / 10000

7.3 Profile Manufacture Objects (A,b,C,H,P group)

INDEX	Parameter	Function Name	Size	Unit	Note
0x2401	A001	Frequency source setting	1	-	
0x2501	A201	Frequency source setting,2nd motor	1	-	
0x2402	A002	Run command source setting	1	-	
0x2502	A202	Run command source setting,2nd motor	1	-	
0x2403	A003	Base frequency	2	1.Hz	
0x2503	A203	Base frequency, 2nd motor	2	1.Hz	
0x2404	A004	Maximum frequency	2	1.Hz	
0x2504	A204	Maximum frequency, 2nd motor	2	1.Hz	
0x2405	A005	“AT” terminal selection	1	-	
0x2411	A011	O start	2	0.1Hz	
0x2412	A012	O end	2	0.1Hz	
0x2413	A013	O start rate	1	1.%	
0x2414	A014	O end rate	1	1.%	
0x2415	A015	O start selection	1	-	
0x2416	A016	O, OI sampling	1	times	
0x2420	A020	Multi-speed 0	2	0.1Hz	
0x2520	A220	Multi-speed 0, 2nd motor	2	0.1Hz	
0x2421	A021	Multi-speed1	2	0.1Hz	
0x2422	A022	Multi-speed2	2	0.1Hz	
0x2423	A023	Multi-speed3	2	0.1Hz	
0x2424	A024	Multi-speed4	2	0.1Hz	
0x2425	A025	Multi-speed5	2	0.1Hz	
0x2426	A026	Multi-speed6	2	0.1Hz	
0x2427	A027	Multi-speed7	2	0.1Hz	
0x2428	A028	Multi-speed8	2	0.1Hz	
0x2429	A029	Multi-speed9	2	0.1Hz	
0x2430	A030	Multi-speed10	2	0.1Hz	
0x2431	A031	Multi-speed11	2	0.1Hz	
0x2432	A032	Multi-speed12	2	0.1Hz	
0x2433	A033	Multi-speed13	2	0.1Hz	
0x2434	A034	Multi-speed14	2	0.1Hz	
0x2435	A035	Multi-speed15	2	0.1Hz	
0x2438	A038	Jogging frequency	2	0.1Hz	
0x2439	A039	Jog stop mode	1	-	
0x2441	A041	Torque boost method selection	1	-	
0x2541	A241	Torque boost method selection, 2nd motor	1	-	
0x2442	A042	Manual torque boost	1	1.%	
0x2542	A242	Manual torque boost, 2nd motor	1	1.%	
0x2443	A043	Manual torque boost point	2	0.1%	
0x2543	A243	Manual torque boost point,2nd motor	2	0.1%	
0x2444	A044	V/f characteristic curve selection	1	-	
0x2544	A244	V/f characteristic curve selection 2nd motor	1	-	

INDEX	Parameter	Function Name	Size	Unit	Note
0x2445	A045	Output voltage gain	1	1.%	
0x2545	A245	Output voltage gain,2nd motor	1	1.%	
0x2446	A046	I-SLV Voltage compensate gain	2	1.%	
0x2546	A246	I-SLV Voltage compensate gain, 2nd motor	2	1.%	
0x2447	A047	I-SLV Slip compensate gain	2	1.%	
0x2547	A247	I-SLV Slip compensate gain,2nd motor	2	1.%	
0x2451	A051	DC braking enable	1	-	
0x2452	A052	DC braking frequency setting	2	0.1Hz	
0x2453	A053	DC braking wait time	1	1.0	
0x2454	A054	DC braking during decelerating	1	1.	
0x2455	A055	DC braking time for deceleration	2	0.1Hz	
0x2456	A056	DC braking enable input signal edge/level selection	1	-	
0x2461	A061	1st frequency upper limit setting	2	0.1Hz	
0x2561	A261	2nd frequency upper limit setting	2	0.1Hz	
0x2462	A062	1st frequency upper limit setting	2	0.1Hz	
0x2562	A262	2nd frequency upper limit setting	2	0.1Hz	
0x2463	A063	Jump frequency1	2	0.1Hz	
0x2464	A064	Jump frequency Width 1	2	0.1Hz	
0x2465	A065	Jump frequency2	2	0.1Hz	
0x2466	A066	Jump frequency Width 2	2	0.1Hz	
0x2467	A067	Jump frequency3	2	0.1Hz	
0x2468	A068	Jump frequency Width 3	2	0.1Hz	
0x2471	A071	PID enable	1	-	
0x2472	A072	PID-P gain	1	0.1	
0x2473	A073	PID-I gain	2	0.1	
0x2474	A074	PID-D gain	2	0.01	
0x2475	A075	PID scale	2	0.01	
0x2476	A076	PID feedback selection	1	-	
0x2477	A077	Reverse PID	1	-	
0x2478	A078	PID Output limiter	2	0.1%	
0x2481	A081	AVR selection	1	-	
0x2482	A082	Motor voltage selection	2	1.V	
0x2492	A092	Acceleration time2	4	0.01sec	
0x2592	A292	Acceleration time2(2nd motor)	4	0.01sec	
0x2493	A093	Deceleration time2	4	0.01sec	
0x2593	A293	Deceleration time2(2nd motor)	4	0.01sec	
0x2494	A094	Select method to switch to Acc2/Dcc2 profile	1	-	
0x2594	A294	Select method to switch to Acc2/Dcc2 profile (2nd motor)	1	-	
0x2495	A095	Acc1 to Acc2 frequency transition point	2	0.1Hz	
0x2595	A295	Acc1 to Acc2 frequency transition point(2nd motor)	2	0.1Hz	
0x2496	A096	Dcc1 to Dcc2 frequency transition point	2	0.1Hz	
0x2596	A296	Dcc1 to Dcc2 frequency transition point(2nd motor)	2	0.1Hz	
0x2497	A097	Acceleration curve selection	1	-	
0x2498	A098	Deceleration curve selection	1	-	

INDEX	Parameter	Function Name	Size	Unit	Note
0x24A1	A101	OI start	2	0.1Hz	
0x24A2	A102	OI end	2	0.1Hz	
0x24A3	A103	OI start rate	1	1.%	
0x24A4	A104	OI end rate	1	1.%	
0x24A5	A105	OI start selection	1	-	
0x24E1	A141	Cal.frequency1	1	-	
0x24E2	A142	Cal.frequency2	1	-	
0x24E3	A143	Cal. select	1	-	
0x24E5	A145	Set point frequency	2	0.1Hz	
0x24E6	A146	Plus/Minus select	1	-	
0x24F1	A151	Pot start	2	0.1Hz	
0x24F2	A152	Pot end	2	0.1Hz	
0x24F3	A153	Pot start rate	1	1.%	
0x24F4	A154	Pot end rate	1	1.%	
0x24F5	A155	Pot start selection	1	-	
0x2601	b001	Automatic Restart Selection	1	-	
0x2602	b002	Allowable under-voltage power failure time	1	0.1	
0x2603	b003	Retry wait time	2	0.1sec	
0x2604	b004	Instantaneous power failure/under-voltage trip during stop	1	-	
0x2605	b005	Instantaneous power failure/under-voltage retry time selection	1	-	
0x2612	b012	Electronic thermal level	2	0.01%	
0x2712	b212	Electronic thermal level(2nd motor)	2	0.01%	
0x2613	b013	1st electronic thermal characteristic selection	1	-	
0x2713	b213	2nd electronic thermal characteristic selection	1	-	
0x2621	b021	Overload restriction operation mode	1	-	
0x2721	b221	Overload restriction operation mode,2nd motor	1	-	
0x2622	b022	Overload restriction setting	2	0.01%	
0x2722	b222	Overload restriction setting,2nd motor	2	0.01%	
0x2623	b023	Deceleration rate at Overload restriction	2	0.1sec	
0x2723	b223	Deceleration rate at Overload restriction,2nd motor	2	0.1sec	
0x2628	b028	Overload restriction source selection	1	-	
0x2728	b228	Overload restriction source selection, 2nd motor	1	-	
0x2631	b031	Software lock mode selection	1	-	
0x2680	b080	AM adjustment	1	1.%	
0x2682	b082	Start frequency adjustment	2	0.1Hz	
0x2683	b083	Carrier Frequency setting	1	0.1kHz	
0x2684	b084	Initialization mode	1	-	
0x2685	b085	Country code for initialization	1	-	
0x2686	b086	Frequency scaling conversion factor	2	0.1	
0x2687	b087	STOP key enable	1	-	
0x2688	b088	Restart mode after FRS	1	-	
0x2689	b089	Monitoring selection	1	-	
0x2690	b090	Dynamic braking usage	2	0.1%	

INDEX	Parameter	Function Name	Size	Unit	Note
0x2691	b091	Stop mode selection	1	-	
0x2692	b092	Cooling fan control	1	-	
0x2695	b095	BRD selection	1	-	
0x2696	b096	BRD ON level	2	1.V	
0x26D0	b130	OV LAD STOP selection	1	-	
0x26D1	b131	OVLAD STOP level	2	1.V	
0x26E0	b140	Over current prevention	1	-	
0x26F0	b150	Carrier Mode	1	-	
0x2801	C001	Intelligent terminal 1 function setting	1	-	*1
0x2901	C201	Intelligent terminal 1 function setting,2nd motor	1	-	*1
0x2802	C002	Intelligent terminal 2 function setting	1	-	*1
0x2902	C202	Intelligent terminal 2 function setting,2nd motor	1	-	*1
0x2803	C003	Intelligent terminal 3 function setting	1	-	*1
0x2903	C203	Intelligent terminal 3 function setting,2nd motor	1	-	*1
0x2804	C004	Intelligent terminal 4 function setting	1	-	*1
0x2904	C204	Intelligent terminal 4 function setting,2nd motor	1	-	*1
0x2805	C005	Intelligent terminal 5 function setting	1	-	*1
0x2905	C205	Intelligent terminal 5 function setting,2nd motor	1	-	*1
0x2806	C006	Intelligent terminal 6 function setting	1	-	*1
0x2906	C206	Intelligent terminal 6 function setting,2nd motor	1	-	*1
0x2811	C011	Intelligent terminal 1 active state	1	-	
0x2812	C012	Intelligent terminal 2 active state	1	-	
0x2813	C013	Intelligent terminal 3 active state	1	-	
0x2814	C014	Intelligent terminal 4 active state	1	-	
0x2815	C015	Intelligent terminal 5 active state	1	-	
0x2816	C016	Intelligent terminal 6 active state	1	-	
0x2821	C021	Intelligent output 11 setting	1	-	
0x2822	C022	Intelligent output 12 setting	1	-	
0x2826	C026	Alarm relay output	1	-	
0x2828	C028	AM selection	1	-	
0x2831	C031	Terminal 11 active state	1	-	
0x2832	C032	Terminal 12 active state	1	-	
0x2836	C036	Alarm relay active state	1	-	
0x2841	C041	Overload advance notice level	2	0.01%	
0x2941	C241	Overload advance notice level,2nd motor	2	0.01%	
0x2842	C042	Frequency arrival setting for acceleration.	2	0.1Hz	
0x2843	C043	Arrival frequency setting for deceleration.	2	0.1Hz	
0x2844	C044	PID deviation level setting	2	0.1Hz	
0x2852	C052	PID feedback High-LIM	2	0.1Hz	
0x2853	C053	PID feedback Low-LIM	2	0.1Hz	
0x2871	C071	Communicating transmission speed	1	-	
0x2872	C072	Communication code	1	1.Node	
0x2874	C074	Communication parity	1	-	
0x2875	C075	Communication stop bit	1	-	
0x2876	C076	Comm. Error select	1	-	

Note *1: Please transmit twice continuously at the change of the value of C001 to C006.

INDEX	Parameter	Function Name	Size	Unit	Note
0x2877	C077	Comm. Error time	2	0.01sec	
0x2878	C078	Communication waiting time	2	1.msec	
0x2881	C081	O input scan calibration	2	0.1%	
0x2882	C082	OI input scan calibration	2	0.1%	
0x2885	C085	Thermistor adj.	2	0.1%	
0x2886	C086	AM offset adjustment	2	0.1V	
0x2891	C091	Debug mode enable	1	-	
0x28A1	C101	UP/DWN selection	1	-	
0x28A2	C102	Reset selection	1	-	
0x28E1	C141	Logic output1	1	-	
0x28E2	C142	Logic output2	1	-	
0x28E3	C143	AND/OR/XOR select	1	-	
0x28E4	C144	ON delay time (OUTPUT11)	2	0.1sec	
0x28E5	C145	OFF delay time (OUTPUT11)	2	0.1sec	
0x28E6	C146	ON delay time (OUTPUT12)	2	0.1sec	
0x28E7	C147	OFF delay time (OUTPUT12)	2	0.1sec	
0x28E8	C148	ON delay time (RY)	2	0.1sec	
0x28E9	C149	OFF delay time (RY)	2	0.1sec	
0x2A03	H003	1st allowable motor capacity	1	-	
0x2B03	H203	2nd allowable motor capacity	1	-	
0x2A04	H004	1st motor pole setting	1	-	
0x2B04	H204	2nd motor pole setting	1	-	
0x2A06	H006	1st stabilizing factor	2	1.%	
0x2B06	H206	2nd stabilizing factor	2	1.%	
0x2A07	H007	1st motor voltage select	1	-	
0x2B07	H207	2nd motor voltage select	1	-	
0x2F44	P044	Timer setting of communication timeout Whilst running	2	0.1sec	
0x2F45	P045	Inverter action When communication error.	1	-	
0x2F46	P046	Polled I/O OUTPUT Instance number	1	-	
0x2F47	P047	Polled I/O INPUT Instance number	1	-	
0x2F48	P048	Inverter action When Idle mode detected.	1	-	
0x2F49	P049	Motor poles setting for revolution per minute	1	-	

7.4 Saving Parameters to EEPROM

The purpose of this object is to save all inverter parameter to the Inverter's EEPROM.

INDEX	Function Name	Size	Note
0x2F00	EEPROM write command	1	

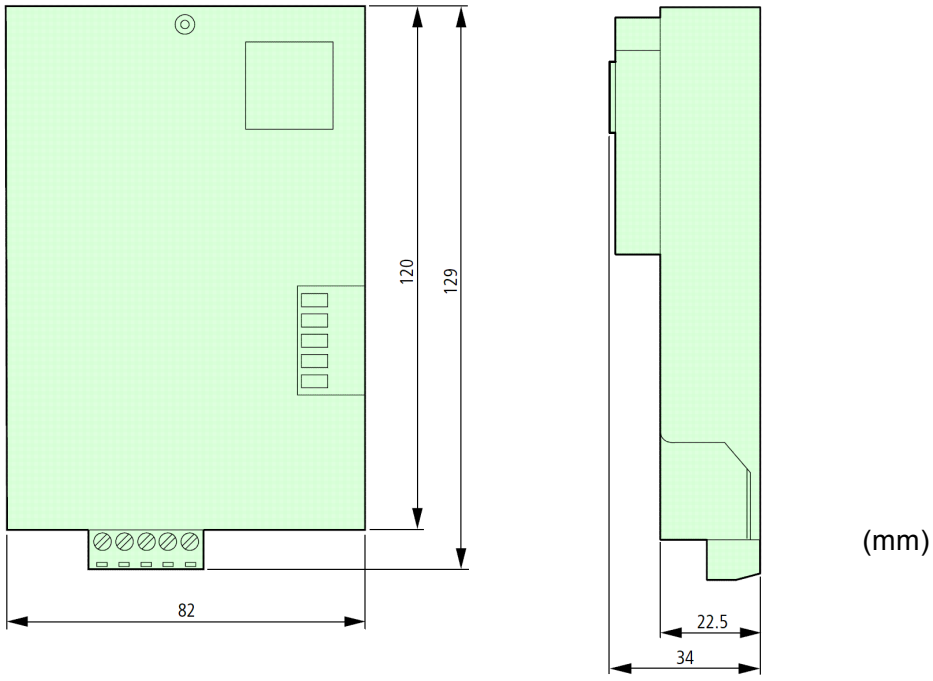
The object 0x2F00 is a placeholder for issuing the EEPROM write command. A rising edge 0 -> 1 will start the EEPROM writing process. The method of making edge is write "0" this object then write "1". While the object 0x2F00 is set "1", the inverter is writing data to EEPROM. When finished writing to EEPROM, this object is going to set "0" in automatically. Please surveillance this object, during writing data to EEPROM.

8.1 CANopen Specifications of SJ200-2/L200-2 Series CANopen Option

The table below describes CANopen specifications of "CANopen interface option".

Item	Specifications
Communication Profile	DS-301 V4.01
Device Profile	DS-402 V2.0
Synchronization Object (SYNC)	Yes
Time Stamp Object (TIME)	No
Emergency Object (EMCY)	Yes
Network Management Object	Yes
Number of PDO's	4Rx / 4Tx
PDO Modes	Sync(cyclic) / Sync(acyclic)
PDO Linking	No
PDO Mapping	Variable
Number of SDO's	1 Server / 0 Client
Emergency Message	Yes
Pre-Defined Connection Set	No
Supported baud rates	10kbps/20kbps/50kbps
	/125kbps/250kbps/500kbps
	/800kbps/1Mbps
Supported LED	Module Status LED(MOD)
	CANopen Status LED(CAN)
Network Connector	Open Connector
Supported Node ID/Default	1～127/0
Baud rates/Node ID setting	Dip Switches

8.2 Dimension



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